Claims

1. Method for grafting a chemical compound to a predetermined region of a support substrate (4), comprising:
   a) irradiating selectively the support substrate (4) with electromagnetic radiation and/or particle radiation in order to both define said predetermined region and to form a reactive functional group or a precursor thereof in said predetermined region of the support substrate;
   b) exposing the irradiated support substrate to said chemical compound or to a precursor thereof.

2. Method according to claim 1, characterized in that the step of exposing is carried out simultaneously during the step of irradiating.

3. Method according to claim 1, characterized in that the step of exposing is carried out successively after the step of irradiating.

4. Method according to any of the preceding claims, characterized in that the properties of the predetermined region are controlled in dependency of the parameters of the irradiating step.

5. Method according to claim 4, characterized in that as properties of the predetermined region are considered at least one of the group comprising physical properties,

chemical properties, height, penetration depth and spatial resolution.

6. Method according to claim 4 or 5, characterized in that as parameter of the irradiating step are considered at least one of the group comprising type of radiation, energy of radiation, total dose of radiation and irradiation atmosphere.

7. Method according to any of the preceding claims, characterized in that the support substrate (2) is chosen in the dependency of at least one property of the group containing desired reactive functional group or a precursor thereof, desired property of the support substrate and desired property of the non-irradiated regions.

8. Method according to claim 7, characterized in that the support substrate is of organic or inorganic type and/or of reactive or inert type and/or hydrophilic or hydrophobic type.

9. Method according to any of the preceding claims, characterized in that the reactive functional group is at least one selected from the group comprising hydroperoxides, peroxides, or any type of radicals such as alkyl radical, oxy radical and peroxy radical.

10. Method according to any of the preceding claims, characterized in that UV or X-ray radiation is used as electromagnetical radiation.

11. Method according to claim 10,

characterized in that
interference lithography is used to generate the predefined regions of reactive functional groups.

12. Method according to any of the preceding claims, characterized in that
electron beam is used as particle radiation.

13. Method according to any of the preceding claims, characterized in that
the compound or the predecessor of the compound is an organic monomer that is applied in form of a gas comprising the monomer or a liquid comprising the monomer to the predetermined region.

14. Method according to claim 13, characterized in that
the monomer is a radically active monomer.

15. Method according to claim 13 or 14, characterized in that
the monomer is used as a pure liquid or is diluted with a solvent or an inert material and/or a mixture with one or more additional monomers.

16. Method according to any of the preceding claims, characterized in that
the predetermined regions formed in the shape of a three dimensional tube or channel.

17. Method according to any of the preceding claims, characterized in that
the grafted material is detached from the support substrate or the support substrate is dissolved leading to free standing structures of the grafted material.

18. A micro- or nanostructured material prepared by the process of any of the claims 1 to 17.

19. A micro- or nanostructured material of claim 18, characterized in that
the substrate is a polymer and the compound is a polymer.

20. A micro- or nanostructured material of claim 18 or 19,
characterized in that
the non-structured regions are hydrophobic and the modified grafted regions are hydrophilic.

21. A micro- or nanostructured material of claim 18 or 19,
characterized in that
the non-structured regions are hydrophilic and the modified grafted regions are hydrophobic.

22. A micro- or nanostructured material of any of the preceding claims 18 to 21,
characterized in that
the modified grafted regions comprises polymer brushes.

23. A micro- or nanostructured material of any of the preceding claims 18 to 22.
characterized in that
the compound is selected from the group comprising acrylic, vinyl and styrenic polymers.

24. A micro- or nanostructured material according to any of the preceding claims 18 to 23
characterized in that
the compound is selected from the group comprising polyacrylic acid and its salts, polymethacrylic acid and its salts, polymethylmethacrylate, polystyrene,

sulfonated polystyrene and its salts, polyethylene, polytetrafluoroethylene, and polypropylene.

25. A micro- or nanostructured material according to any of the claims 18 to 24, characterized in that the compound has functional groups capable of selectively binding with chemical elements, functional groups or molecules present in a gaseous or liquid phase.

26. A micro- or nanostructured material according to any of the preceding claims 18 to 25, characterized in that the compound has functional groups selected from the group comprising amine, amide, thiol, hydroxy, carboxyl, carboxylic acid, or ester functional groups.

27. A micro- or nanostructured material to any of the preceding claims 18 to 26, characterized in that the substrate is modified through its entire thickness.

28. A micro- or nanostructured material of any of the preceding claims 18 to 27, characterized in that a membrane is used for a separation, transport or conduction application.

29. A micro- or nanostructured material of claim 28, characterized in that the membrane is used in an electrochemical cell.

30. A micro- or nanostructured material of any of the preceding claims 18 to 29, characterized in that the substrate is a flexible polymer film.

31. A micro- or nanostructured material of claim 30, characterized in that
the polymer film is selected from the group comprising PTFE, FEP, ETFE, PVDF, PE, and PP.

32. The use of the micro- or nanostructured material of any of the preceding claims 18 to 31 in a combinatorial chemistry, biotechnological, or separation application.

33. A material comprising a polymer substrate having at least one region of grafted polymer,
wherein at least one lateral dimension of said region is between about 1 nanometer and about 5 micrometers.

34. A material as recited in claim 33, wherein said lateral dimension is between about 1 nanometer and about 1 micrometer.

35. A material as recited in claim 34, wherein said lateral dimension is between about 1 nanometer and about 500 nanometers.

36. A material comprising a polymer substrate having at least one region of grafted polymer,
wherein the height of said region is between about 1 nanometer and about 5 micrometers.

37. A material comprising a polymer substrate having at least one region of grafted polymer,
wherein the height of said region is between about 1 nanometer and about 1 micrometer.

38. A material comprising a polymer substrate having at least one region of grafted polymer,
wherein the height of said region is between about 1 nanometer and about 500 nanometers.

39. A material as recited in any of the preceding claims 33 to 38, wherein said regions are arranged in a periodic manner.

40. A material as recited in any of the preceding claims 33 to 39, wherein the shape of said regions is selected from the group consisting of dots, circles, polygons, or lines.

41. A material as recited in any of the preceding claims 33 to 40, wherein the form of said regions is a grid.

42. A material as recited in any of the preceding claims 33 to 41, wherein the substrate is flexible.

43. A material as recited in any of the preceding claims 33 to 42, wherein the substrate is extruded.

44. A material as recited in any of the preceding claims 33 to 43, wherein the substrate is a film.

45. A material as recited in any of the preceding claims 33 to 44, wherein the substrate is hydrophobic.

46. A material as recited in the preceding claim 45, wherein the substrate is a fluoropolymer.

47. A material as recited in any of the preceding claims 33 to 46, wherein the substrate is hydrophilic.

48. A material as recited in any of the preceding claims 33 to 47, wherein the grafted polymer is hydrophilic.

49. A material as recited in any of the preceding claims 33 to 48, wherein the grafted polymer is able to exchange ions.

50. A material as recited in any of the preceding claims 33 to 49, wherein the grafted polymer is hydrophobic.

51. A material as recited in any of the preceding claims 18 to 50, wherein the grafted polymer is conducting, semi-conducting, or photo-conducting.

52. A material as recited in the preceding claim 51, wherein the grafted polymer also has chemical sensing characteristics.

53. A process in which a material prepared by any of the processes, as recited in any of the preceding claims 18 to 52, is used to generate patterns in other materials.

54. A process in which any of the materials, as recited in any of the preceding claims 18 to 52, is used to generate patterns in other materials.